



National Aeronautics and
Space Administration

Observations and Opportunities: Standards System and Waiver Processes



**Alcoa Corporation
Corporate Center
Pittsburgh, Pennsylvania**

**A Benchmarking Report Prepared by the
NASA Office of Safety & Mission Assurance
Review & Assessment Division**

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Executive Summary

The August 24, 2004, benchmarking activity with Alcoa Corporation provided the NASA review team with insight into Alcoa's Standards and waiver processes, and contractor safety requirements.

Key observations include:

- 1.) Environmental, Health and Safety (EHS) Standards are considered mandatory for all Alcoa world-wide locations, operations, and products.
- 2.) Engineering Standards are considered best practices and are not mandatory.
- 3.) Alcoa considers it overly prescriptive and restrictive to have a single technical individual serve as a Standard owner.
- 4.) Alcoa maintains that a single individual as the ultimate authority on a given Standard may have too much power, or worse, simply know too little about complex technical subject matter associated with a Standard in its various company applications.
- 5.) In general, the same Standards used by Alcoa are applied to new contracts via contract and procurement language. In some cases a contractor's practices may be used in lieu of Alcoa Standards as long as they are equivalent.
- 6.) Standards are evaluated every three years. Alcoa works to improve requirements and processes with each of these reviews, in essence raising the bar for performance across the company.
- 7.) Alcoa deliberately discourages waiver requests from occurring in the first place. Alcoa stresses and expects a proactive approach from its management and workers to resolve non-compliance issues instead of seeking waivers.
- 8.) Ongoing non-compliance (non-conformance) is referred to as an "exception." During times of non-compliance to Safety Standards, Alcoa supplements the non-compliant operations with processes, procedures, and resources (called "compensating controls") to manage and mitigate the risk associated with non-compliance. These compensating controls are equivalent to NASA's hazard controls.

The NASA benchmarking review team derived a number of opportunities with the potential to assist NASA in the transformation to a stronger safety culture. Those opportunities include:

- 1.) Establishing lists of "go-to" experts on NASA Standards that provide support, perform analysis, and resolve issues and non-compliances associated with NASA Standards.
- 2.) Developing SMA risk acceptance guidelines in complex programs/projects when multiple authorities may be responsible for risk ownership and waiver acceptance.
- 3.) Enhancing NASA's quick-response system to communicate mishap lessons learned to multiple stakeholders (including NASA Standards owners) that can benefit and get the message to the workforce on short notice.
- 4.) Increasing the frequency of safety reports to senior management so that this information may be flowed down to line management and employees.
- 5.) Deriving greater utility from mishap, close call, and lessons learned information by developing short, single-point lessons that emphasize safety awareness (one-page summaries with a descriptive photo) to be disseminated by line management to employees.

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1.0 Introduction & Background

NASA External Benchmarking Activities – Background

NASA has a long history of conducting benchmarking with external organizations, most recently reviewing several U.S. Navy programs as part of the ongoing NASA/Navy Benchmarking Exchange (NNBE) begun in August of 2002. These reviews have included the Naval Sea Systems Command Submarine Safety (SUBSAFE) Program and Naval Nuclear Propulsion Program and have been extremely valuable in providing insight into best practices for safety used in other large complex programs. This insight has been used to enhance NASA's Safety and Mission Assurance activities by introducing new capabilities, including recently implemented compliance verification initiatives. Alcoa is the one of the latest benchmarking activities designed to promote insight into their safety policies, processes, and practices.

Alcoa Benchmarking – Overview

On August 24, 2004, a NASA benchmarking team visited the Alcoa Corporation at their Corporate Center facility in Pittsburg, Pennsylvania. The goal of this activity was to gather best-practices information regarding Alcoa Corporation's Standards and waiver processes, and contractor safety requirements.

Team Composition

The NASA Office of Safety and Mission Assurance (OSMA) review team was led by Mr. Bryan O'Connor, Chief Safety and Mission Assurance Officer, and supported by core team members Dr. Michael Stamatelatos (OSMA/SARD), Mr. Wilson Harkins (OSMA/SARD), and Mr. Mark Kowaleski (OSMA/MSD). Support from Alcoa was provided by Mr. Rick Williams (Senior Safety Director), with assistance from Mr. William Gallagher and Mr. Robert Slack.

Benchmarking Approach

The Alcoa benchmarking plan focused on two primary topics:

- 1) The Alcoa Standards process, including:
 - a) How exceptions or waivers are managed,
 - b) Role of the Technical Contacts,
 - c) Impact on accountability,
 - d) Alcoa parallel to NASA "requirements", and
 - e) Current improvement efforts.
- 2) Alcoa contractor safety requirements, including:
 - a) How Alcoa Standards are applied,
 - b) How Alcoa manages accountability,
 - c) Alcoa as a general contractor, and

- d) How Alcoa deals with contractors or new acquisitions that cannot meet their Standards in the near-term.

The benchmarking visit consisted of a single, 4-hour meeting, and this report summarizes the information collected during this activity.

2.0 Summaries and Key Observations

This section provides summaries and key observations regarding Alcoa Corporation's Standards and waiver processes, and contractor safety requirements. This section is divided into the following categories to organize the information gathered by the benchmarking team.

- Standards System
 - Corporate Perspective
 - Hierarchy and Categories
 - Ownership
 - Application to Contractors
 - Management
- Waiver Processes
- Audits and Non-compliances
- Risk Acceptance
- Appeal Paths
- Mishap Reporting Process
- Safety Statistics
- Corporate and Matrixed Safety Support
- Miscellaneous Observations

2.1. Standards System

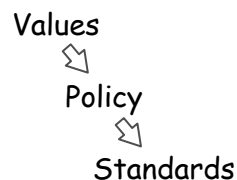
Corporate Perspective

Safety performance is an Alcoa company value held in high esteem. Professional integrity and recognition serve as incentives to achieving high levels of safety.

Within Alcoa, corporate goals are stressed rather than focusing on the specifics of how a particular plant manages its safety program. Plants may vary their operations from one site to another due to variances in process, machinery, regional laws, etc. However, the focus at each particular plant is always on "How will the corporate goal of zero mishaps be achieved?"

Hierarchy and Categories

The Alcoa Standards System is based on the following hierarchy:



Values are reflected in Alcoa's top-level documents: Policy and Operating Principles. Operating Principles are specifically targeted towards management and used to measure

management's commitment. Policy and Operating Principles are reflected in Alcoa Standards.

There are four categories of Alcoa Standards:

1. Environmental, Health, and Safety (EHS)

- EHS Standards define “minimum performance” and are considered *mandatory*.
- Alcoa's EHS policy identifies four Critical Safety Standards categories based on historical areas where fatalities or injuries have occurred. These areas include:
 - 1) Confined Spaces,
 - 2) Fall Control,
 - 3) Lockout Program, and
 - 4) Mobile Equipment.
- EHS Standards are approved by the Alcoa Executive Council.
- All EHS standards have world-wide applicability to all locations, operations, and products.
- Variances to EHS Standards require a waiver if there is not adequate control of residual risk.
- Alcoa has approximately 62 Safety Standards at the corporate level.

2. Engineering

- Engineering Standards describe the “how to” and are considered as *best practices*, not mandatory.
- Business unit managers may choose to identify an Engineering Standard as mandatory for the product or operation for which they are responsible.
- Engineering Standards deviations do not require a waiver.
- Alcoa has approximately 500 Engineering Standards.

3. Internal

- Internal Standards address “making the product” and are often proprietary.

4. Quality

- Quality Standards address requirements and certification (e.g., ISO 9000).

Most Safety Standards started out historically as Engineering Standards, or they always had a simultaneous EHS and engineering component. “Voluntary Consensus Standards” are adopted from industrial groups (e.g., ASTM) and are treated as preferred standards. Alcoa does not have to write its own Standard to address these topics.

It is worth noting that Alcoa differs from NASA in that they do not separate Directives from Standards. Within Alcoa, Standards include roles and responsibilities that within NASA would typically be documented in Directives (i.e., NASA Policy Directives and NASA Procedural Requirements documents).

Ownership

Alcoa works with complex and multi-dimensional standards (e.g., similar to NASA's complex Human Rating document). As an example, Alcoa presented the topic of crane operations. There are many different aspects to crane operations, and many such Standards rely on a committee environment to provide expertise, perform analysis, and resolve issues with a crane Standard. Often, the Standard owner is really representing a committee that backs that person.

Alcoa considers it overly prescriptive and restrictive to have a single technical individual serve as a Standard owner.

Standards ownership requires an understanding of the "big picture" in order to define, apply, interpret, and comply with a complex Standard such as crane operations.

Alcoa maintains that a single individual as the ultimate authority on a given Standard may have too much power, or worse, simply know too little about complex technical subject matter associated with a Standard in its various company applications.

Additionally, Alcoa stressed that an important key is that the Standards owners and committee members are sincerely interested in managing the Standards that they are assigned. Such individuals are usually passionate subject matter experts. Alcoa provides significant corporate involvement to develop Standards that are not overly prescriptive or restrictive.

Application to Contractors

Alcoa has a Standard on managing contractors that is driven primarily by Alcoa's acquisition of other companies. All newly hired contractors are required to have a "responsible person" to work together with an Alcoa responsible person to apply Standards. In general, the same Standards used by Alcoa are applied to new contracts through contract and procurement statements.

In some cases a contractor's practices may be used in lieu of Alcoa Standards as long as they are equivalent. However, there are cases where the Alcoa Standard may not be immediately or ever applied, even if the Alcoa Standard is more stringent. The decision for how these Standards are applied is delegated to the contract managers.

Often times there are no specific Alcoa Standards available for the type of work being performed. For example, tower construction using helicopter operations involves disciplines for which Alcoa has no particular expertise. Such situations often involve Alcoa serving as the general contractor, whereby individual pieces of work are subcontracted but the overall effort is managed by Alcoa. The business unit manager normally makes the trade-offs associated with a particular Standard.

Alcoa uses a pre-screening process to pre-qualify companies to work as contractors to Alcoa. The contractors themselves are responsible for the safety of their contractual operations, and they must be managed by an onsite contractor employee who serves as the responsible party.

Management

Standards are evaluated every three years. Alcoa works to improve requirements and processes with each of these reviews, in essence raising the bar for performance across the company. These changes are done in coordination throughout Alcoa to ensure all parties are aware of the requirements and to establish realistic expectations for performance across the company. (By comparison, NASA requires a five year review cycle for all Directives and Standards.)

Alcoa employs an online Standards System that allows access to all contractors and selected employees on an as-needed basis.

2.2. Waiver Processes

Alcoa deliberately avoids putting waiver process instructions into the technical standards themselves – the idea is to discourage waiver requests from occurring in the first place. Alcoa stresses and expects a proactive approach from its management and workers to resolve non-compliance issues instead of seeking waivers.

Alcoa only considers variances from requirements when there is a change in risk level that requires a corporate-level waiver. Use of alternate means to accomplish a requirement that does not result in a change in risk is resolved at a lower level without a waiver. All of these lower level decisions are subject to review during periodic audits.

When required, variances from mandatory Alcoa Standards are treated in three different ways:

- 1) Variances from new or revised requirements that exist upon the release of a Standard are identified, and a plan to achieve compliance is prepared and implemented. Performance against the plan is monitored and tracked. Such new or revised Standards always allow a specified window of time to achieve compliance with the new/revised requirements.
- 2) Variances that are identified during an audit are categorized and documented as *non-compliances*, and a plan to achieve compliance is prepared and implemented. Implementation is tracked and is generally required prior to the next audit cycle.
- 3) Variances identified as necessary after a process, project or other activity is already in development or underway require a *formal waiver*. The appropriate mandatory point of contact for the Standard is involved in the process to assess risk and to recommend if the waiver should be considered reasonable for

approval. The risk assessment process is based on performing qualitative and quantitative analysis and includes input from supporting subject matter experts.

Only in rare situations is the Senior Safety Director required to engage in a waiver request (perhaps 2 to 3 per year). The Director relies on his subject matter experts to work with the requestors to identify compensating controls, thus avoiding the need for a waiver. (“Compensating control” is Alcoa’s term for controls or mitigation strategies implemented to control a hazard.)

Operating/field personnel are obligated to request authority/approval for safety variances, and a Standards “owner” generally relies on recognized subject matter experts to provide the technical basis for whether to accept or reject a waiver or exception.

Usually, deviations are handled first at the working level between the field operations and the engineering subject matter experts. The idea is to address the details of the issue and understand a range of options at the working level before it gets raised to senior management.

Currently, regional variations in standards are difficult to manage and most challenging for Alcoa. As a result, auditors are trained to handle differences in practices throughout the world.

2.3. Auditing and Non-Compliances

Auditing

Auditing is a key factor in the success of Standards, and corporate-level reporting of audit statistics occurs every quarter. Audits are used to check on processes, and the focus of audits ranges from top-level management to the floor-level machine operator. If a non-risk change gets approved at the local level, it is reviewed during the audit process. During compliance audits, management is audited for their level of commitment to corporate policy, while employees and floor workers are audited for compliance to Safety Standards.

Alcoa utilizes a standing team of lead auditors supported by subject matter experts throughout the company (e.g., EHS or engineering experts). In addition, Alcoa periodically uses statistical correlation between audit results and safety statistics.

Non-Compliances

From the very beginning, Alcoa treats audit non-compliances differently from granting waivers. A non-compliance resulting from an audit is not treated as waiver because the non-compliance follow-up process provides sufficient visibility. Deviations and waivers are often managed through the audit and corrective action processes.

Alcoa overcomes a non-compliance by requiring a “compliance plan” that includes target milestones for making machinery/operations compliant. Subsequent audits are performed against this plan, which always requires full compliance within a specified time-period.

Ongoing non-compliance (non-conformance) is referred to as an “exception.” During times of non-compliance to Safety Standards, Alcoa supplements the non-compliant operations with processes, procedures, and resources (called “compensating controls”) to manage and mitigate the risk associated with non-compliance. These compensating controls are equivalent to NASA's hazard controls.

2.4. Risk Acceptance

The risk of incurring an accident during the interim time-period of non-compliance is treated by Alcoa as an “accepted risk.” This is justified because there is a plan in place that is being executed to eventually achieve compliance. Alcoa stressed that not accepting the risk during these transition times would cripple Alcoa’s operations and ability to remain competitive. For example, Alcoa frequently inherits machinery and operations through new acquisitions (especially in foreign countries) that are not compliant with Safety Standards. Often, it is not practical to suspend these operations because the ability to produce the product would be compromised. Alcoa noted that for global operations, the official “value of life” varies from country to country, as do standards for working conditions.

Program managers accept risk on behalf of their business unit or Alcoa as a company. The individuals directly ‘at-risk’ are not routinely part of the risk acceptance process (e.g., floor workers). However, there have been instances of workers refusing to accept a risk when a new process or equipment is presented to them and these refusals are honored.

An interesting discussion followed regarding risk acceptance on behalf of those individuals that it affects. NASA discussed the Tropical Rainfall Measuring Mission (TRMM) satellite as an example. The TRMM satellite collects data for hurricane prediction models and tracking, which ultimately makes people safer. However, over time NASA inevitably faces the decision on whether keep the TRMM satellite in orbit at the risk of having an uncontrolled reentry due to lower levels of consumables onboard (e.g., propellant to control reentry). Portions of the public remain safer from hurricanes, but others in different parts of the world are less safe from potential impacts of satellite debris. Such a safety trade inherently involves accepting risk on behalf of people not involved in the process.

2.5. Appeal Paths

EHS world-wide directors approve or disapprove all Standards variances. If the business unit manager disagrees with the directors’ position, it can be appealed first to the business unit Vice President and then to the Alcoa President.

In cases where there are differences between programmatic and institutional standards, the institutional/corporate side of Alcoa has the last word in this process. The business unit manager usually resolves institutional vs. business issues, but they can escalate all the way to the corporate level (President) when required. There are many situations where the business unit manager may be even more conservative than the safety community at Alcoa; however, the institutional safety manager has an appeal path all the way to the President if necessary.

Alcoa provides multiple ways to raise a safety concern (e.g., phone hotline, committees, management, etc.) similar to NASA. For example, Alcoa has an “Ethics and Compliance Hotline” that is similar to the NASA Safety Reporting System (NSRS).

2.6. Mishap Reporting Process

All mishaps and close-calls are required to be reported within 24 hours of occurrence. Anyone at the location may initiate the mishap report.

All incidents are reviewed by the committee associated with a particular Standard. For example, all crane mishaps are reviews by the Crane Standards Committee. Reviewing all mishaps is a key function of the Standards committees.

2.7. Safety Statistics

EHS corporate collects and reports safety statistics to senior management. Alcoa stressed that information systems and the use of digital pictures are very powerful in helping corporate understand the details of a specific situation.

In the past, Alcoa would raise an “incident of the month” to the attention of senior management. This practice caused problems for the owner of the incident, and it made the owners of incidents that were not reported somewhat complacent about their own situation. There was concern that managers not called upon to report a safety issue may have felt that their operation must be doing fine simply because they were not reporting to senior management. Alcoa currently requires monthly “single-point lessons” to be reported on selected incidents.

2.8. Corporate and Matrixed Safety Support

Alcoa has EHS services that it provides through its functional support areas. These are often matrixed to provide expertise to support plants and operations that do not have the resources to sustain this expertise in-house.

2.9. Miscellaneous Notes

- Alcoa does not have an equivalent of a Chief Engineer at the corporate level. Rather, engineering is managed by disciplines at the corporate level.

- Alcoa stressed that it uses many high-BTU furnaces and combustion systems in its operations. Alcoa's corporate Standard states that computer-controlled control systems are much safer and more reliable than having a human in the loop. All old systems are being updated over time to include computer-controlled and automated operations.
- Alcoa assigns a Single Point Accountable (SPA) person for high-BTU systems at each site. A new initiative involves providing online training.
- Alcoa does not distinguish between the terms 'accountable' and 'responsible' and uses these words interchangeably.

3.0 NASA Opportunities

The following discussion offers potential improvement and enhancement opportunities as the NASA transformation continues toward a more uniform and more elevated safety culture.

Opportunity #1: Establish Lists of “Go-to” Experts on NASA Standards

Alcoa relies on a committee environment to provide expertise, perform analysis, and resolve issues associated with Standards. Alcoa considers it overly prescriptive and restrictive to have a single technical individual serve as a Standard owner. Ownership requires an understanding of the “big picture” in order to define, apply, interpret, and comply with complex Standards. Generally, the Standards “owner” relies on committee members who are recognized subject matter experts to provide the technical basis for whether to accept or reject a waiver or exception.

NASA Standards owners may wish to establish a solid list of “go-to” experts for their Standards. These Standards owners (i.e., each Office of Primary Responsibility) may wish to take advantage of existing OSMA tools such as the PBMA-KMS Knowledge Registry to identify subject matter experts, and the PBMA-KMS Enhanced Security Work Groups to foster collaboration at the community level on NASA Standards.

Opportunity #2: Develop Guidelines for Accepting Risk in Complex Programs/Projects

Alcoa program managers accept increased risk due to non-compliances on behalf of their business unit or the company as a whole. The individuals directly ‘at-risk’ are not routinely part of the risk acceptance process (e.g., floor workers).

The OSMA recently established a formal variance process specifically for the CALIPSO Program that addresses which individuals have the authority to accept increased safety risks. For example, the NASA Program Manager on CALIPSO does not have sole authority to accept increased safety risks associated with potential propellant spills that could affect a Boeing worker. OSMA determined that any variance from a CALIPSO SMA requirement involving a net increase in risk (i.e., a waiver) must be processed by two authorities: 1.) the authority responsible for the requirement (the OPR or OPR delegate), and 2.) the authority responsible for the people, facilities, or mission.

The OSMA may wish to develop similar guidelines for accepting Safety and Mission Assurance (SMA) risks for other existing/new programs/projects, especially complex ones that may require multiple responsible persons from different organizations to sign-off on risk acceptance. These guidelines would help ensure that the appropriate responsible authorities are involved in the risk acceptance process.

Opportunity #3: Enhance NASA’s Quick Response Lessons Learned System

Alcoa stressed that all mishaps and close-calls are required to be reported within 24 hours of occurrence, and that anyone at the location may initiate the mishap report. Further, a key function of the Standards committees includes reviewing all incidents associated with a particular Standard.

NASA also submits mishap reports to the applicable safety office within 24 hours. In addition, the OSMA may wish to explore enhancing NASA’s quick response system to communicate mishap lessons learned to multiple stakeholders that can benefit and get the message to the workforce on short notice. An enhanced system that actively includes the OPRs and line organizations associated with the incident would help ensure that mishap and close-call information is delivered in a timely fashion for management review and Agency-wide dissemination.

Opportunity #4: Increase the Frequency of Safety Reports to Senior Management

EHS corporate collects and reports safety statistics to senior management and requires monthly “single-point lessons” to be reported on selected incidents.

NASA OSMA, the Chief Engineer’s office, and the Mission Directorates may wish to explore increasing the frequency of reporting safety issues to senior management so that this information may be flowed down to line management and employees.

Opportunity #5: Derive Greater Utility from Mishap, Close Call, and Lessons Learned Information

Alcoa stressed that information systems and the use of digital pictures are very powerful in helping corporate understand the details of a specific mishap situation.

NASA OSMA, the Chief Engineer’s office, and the Mission Directorates may wish to explore incorporating safety information based on aggregated mishaps and close call events into short, single-point lessons that emphasize safety awareness. One-page safety case studies that include a descriptive photo of the mishap or close call could be tailored to specific work areas/professions as appropriate and disseminated by line management to employees. Lessons learned and best practices could also be drawn upon for case study material.

A concurrent benchmarking activity with Bath Iron Works identified a similar lessons-learned opportunity that encourages frequent and active discussion of mishap lessons learned between line management and the workforce. To learn more about how cultural change takes place in discussions, readers are encouraged to review the Bath Iron Works benchmarking report¹, available from the Program Profiles section of the Process Based Mission Assurance (PBMA) Knowledge Management System (<http://pbma.nasa.gov>).

¹ Observations & Opportunities, Safety Culture & Safety Management Leadership, Bath Iron Works, A General Dynamics Company, A Benchmarking Report Prepared by the NASA Office of Safety & Mission Assurance Review & Assessment Division, October 22, 2004.

Glossary

ASTM	American Society for Testing and Materials
BTU	British Thermal Unit
CALIPSO	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations
EHS	Environmental, Health & Safety
NAVSEA	Naval Sea Systems Command
NNBE	NASA/Navy Benchmarking Exchange
NR	Naval Reactors
NSRS	NASA Safety Reporting System
OPR	Office of Primary Responsibility
OSMA	Office of Safety and Mission Assurance
SMA	Safety and Mission Assurance
SPA	Single Point Accountable
SUBSAFE	Navy Submarine Safety
TRMM	Tropical Rainfall Measuring Mission